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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/823,105	04/13/2004	Shunsuke Kobayashi	CU-3682 RJS	4514

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EXAMINER	
HON, SOW FUN	
ART UNIT	**PAPER NUMBER**
1772	

DATE MAILED: 03/08/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/823,105	KOBAYASHI ET AL.	
	Examiner	Art Unit	
	Sow-Fun Hon	1772	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 April 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claim 4 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is unclear which is the particle and which is the nanoparticle when the liquid crystal-soluble particle is not provided with the clear description of claim 1. Furthermore, there is a lack of antecedent basis for "the nanoparticle" and "the liquid crystal molecules" at the beginning of the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-2 are rejected under 35 U.S.C. 102(b) as being anticipated by Suzuki (US 6,376,029).

Suzuki teaches a liquid crystal-soluble particle comprising: a core comprising one particle (nucleus, column 2, lines 1-5); and a protective layer comprising liquid crystal molecules provided on its periphery (thin liquid crystal layer formed on the particle surface, column 2, lines 4-6). The particle has a core diameter of 100 nanometer (0.1 μm, column 4, line 2), which is within the claimed range of from 1 nm to 100 nm, and is thus a nanoparticle as defined by Applicant's specification (original claim 2). The particle comprising a core surrounded by the protective layer of liquid crystal molecules provided on the core's periphery is liquid crystal-soluble due to the outer protective layer of liquid crystal molecules.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki as applied to claims 1-2 above, and further in view of Kobayashi (US 4,701,024).

Suzuki teaches a liquid-crystal soluble particle, comprising a core surrounded by the protective layer of liquid crystal molecules provided on the nanoparticle core's periphery, wherein the core has a diameter of 100 nm, as described above. Suzuki fails to disclose the value of the short axis width of the liquid crystal molecule, and hence

fails to teach that the short axis width of the liquid crystal molecule is equal to or less than the diameter of the nanoparticle core.

However, Kobayashi teaches a core metal particle, wherein liquid crystal molecules are oriented vertical to the surface of the core metal particle (magnetic, column 3, lines 35-36, 52-55), and the length of liquid crystal molecule is 5 nm (50 angstroms, column 3, lines 55-59), which means that the short axis width of the liquid crystal molecule is equal to or less than 5 nm, and is less than the diameter of the core metal particle (length of particle is about 200 nm, or 0.2 μm, column 3, lines 55-56), for the purpose of uniformly and stably dispersing the plural core metal particles in ordinary liquid crystal media (column 3, lines 42-45).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to have used liquid crystal wherein the short axis width of the liquid crystal molecule is equal to or less than the diameter of the core metal particle for the liquid crystal-soluble particle of Suzuki, in order to uniformly and stably disperse the plural core metal particles in the liquid crystal medium, as taught by Kobayashi.

4. Claims 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Won (US 6,712,997) in view of Suzuki (US 6,376,029).

Regarding claim 4, Won teaches a method for manufacturing a matrix-soluble particle (dispersed on a molecular level, column 2, lines 47-50) comprising: a core comprising one or a plurality of metal nanoparticles (composite polymers containing nanometer-sized metal particles in a well-dispersed state in the polymer matrix, column 2, lines 30-34) wherein a plurality of metal ions (Ag+ ClO4-, column 7, lines 30-35) are

reduced (column 2, lines 50-53) in a solution containing the matrix molecules (POZ, column 7, lines 30-35) to allow the matrix molecules to bond to the periphery of the metal nanoparticle (fixing, column 2, lines 50-53). Won fails to teach that the matrix molecules bonded to the periphery of the metal nanoparticle form a particle, or that the matrix molecules are liquid crystal molecules.

However, Suzuki teaches a liquid crystal-soluble particle comprising: a core comprising one metal particle (nucleus, column 2, lines 1-5, metals, column 4, line 1); and a protective layer comprising liquid crystal molecules provided on its periphery (thin liquid crystal layer formed on the particle surface, column 2, lines 4-6). The particle comprising a core surrounded by the protective layer of liquid crystal molecules provided on the core's periphery is liquid crystal-soluble due to the outer protective layer of liquid crystal molecules. Suzuki teaches that the liquid crystal-soluble particle has a selective reflection for polarized light of a specific wavelength (column 1, lines 5-10).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to have modified the method of Won to form a liquid crystal-soluble particle comprising: a core comprising a metal nanoparticle, wherein the plurality of metal ions of Won are reduced in a solution containing liquid crystal molecules to allow the liquid crystal molecules to bond to the periphery of the metal nanoparticle formed, in order to provide a liquid crystal-soluble particle which has selective reflection for polarized light of a specific wavelength, as taught by Suzuki.

Regarding claim 5, Won teaches that the metal nanoparticle is made of at least one kind of metal atom selected from Ag, Pd, Au, Pt, Cu, Fe, Co and Ni (intermetallic, binary alloy, ternary alloy, column 3, lines 15-18).

Regarding claim 6, Won teaches that the metal ion is chosen from at last one metal salt among metal halides ($FeCl_2$, column 10, lines 3-5), metal perhalogenates ($AgClO_4$, column 7, line 33) and metal nitrates ($AgNO_3$, column 7, lines 20).

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi (US 4,701,024) in view of Asano (US 4,909,605) and Suzuki (US 6,392,785).

Kobayashi teaches a liquid crystal device element shown in Fig. 2A (cell, column 4, lines 30-34) comprising: a pair of parallel substrates (transparent plates 5, 6, column 4, lines 34-35); conductive layers provided respectively on facing inner surfaces of these substrates (electrodes 7 and 8 on the inner surfaces, column 4, lines 34-37); and a liquid crystal layer formed in between (liquid crystal molecules 3, column 4, lines 36-38). Kobayashi fails to teach that the liquid crystal layer is formed in between a pair of liquid crystal alignment layers formed on the facing inner surfaces of the pair of conductive layers, wherein the alignment layers are provided respectively with a pre-tilt angle.

However, Asano teaches a liquid crystal display device element wherein the liquid crystal layer is aligned between a pair of liquid crystal alignment layers (pair of substrates each having an alignment layer, column 2, lines 43-47), wherein the liquid crystal alignment layers are provided respectively with a pre-tilt angle (column 3, lines 1-

2), for the purpose of providing a pre-tilt angle to the liquid crystal (column 5, lines 43-50).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to have formed the liquid crystal layer in between a pair of liquid crystal alignment layers formed on the facing inner surfaces of the pair of conductive layers in the liquid crystal device element of Kobayashi, wherein the liquid crystal alignment layers are provided respectively with a pre-tilt angle, in order to provide the desired pre-tilt angle to the liquid crystal, as taught by Asano.

In addition, Kobayashi teaches that metal particles (column 4, lines 66-68) are dispersed in the liquid crystal (column 6, lines 37-40), to provide the liquid crystal with an effective switching function (column 5, lines 35-42). Kobayashi teaches that a particle is formed wherein the metal particle has a protective layer of organic molecules provided on its periphery (treated on the surfaces with DMOAP, column 5, lines 1-3, surface active agent, column 6, lines 37-40), but fails to teach that the organic molecules are liquid crystal molecules, or that the metal particles are metal nanoparticles.

However, Suzuki teaches a liquid crystal-soluble particle comprising: a core comprising one metal particle (nucleus, column 2, lines 1-5, metals, column 4, line 1); and a protective layer comprising liquid crystal molecules provided on its periphery (thin liquid crystal layer formed on the particle surface, column 2, lines 4-6). The particle comprising a core surrounded by the protective layer of liquid crystal molecules provided on the core's periphery is liquid crystal-soluble due to the outer protective layer

of liquid crystal molecules. Suzuki teaches that the particle has a core diameter of 100 nanometer (0.1 μm, column 4, line 2), which is within the claimed range of from 1 nm to 100 nm, and is thus a nanoparticle as defined by Applicant's specification (original claim 2).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to have used liquid crystal molecules as the organic molecules provided on the periphery of the metal core of Kobayashi, in order to obtain better dispersion or solubility in the liquid crystal layer, and to have used metal nanoparticles in place of the metal particles of Kobayashi, in order to take advantage of the physical properties of the nanodimension, as taught by Suzuki.

6. Claims 8-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi in view of Asano and Suzuki, as applied to claim 7 above, and further in view of McKnight (US 6,304,239).

Regarding claims 8-10, Kobayashi in view of Asano and Suzuki teaches the liquid crystal device element as discussed above. In addition, Kobayashi teaches that the liquid crystal device element has a control circuit for applying voltage (Fig. 2A). Kobayashi in view of Asano and Suzuki fails to teach that the control circuit for applying voltage, modulates at least the frequency among the parameters of frequency and voltage, and is provided on the conductive layer, for varying light transmittance of the liquid crystal layer, wherein under a constant applied voltage, an electro-optical response is turned on by switching the frequency of the applied electric field from low frequency to high frequency, and the electro-optical response is turned off by switching

the frequency from high frequency to low frequency, let alone that the frequency modulation range is in a range of 20 Hz to 100 kHz.

However, McKnight teaches a liquid crystal device element (column 1, lines 18-24), wherein a control circuit for applying voltage, while modulating frequency (control voltage is modulated with a high frequency oscillation, column 15, lines 6-10), is provided on the conductive layer (electrode, column 15, lines 6-8) for varying light transmittance of the liquid crystal layer (crossover frequency from positive dielectric anisotropy to negative dielectric anisotropy, column 15, lines 10-14), and under a constant applied voltage, an electro-optical response is turned on by switching the frequency of the applied electric field from low frequency to high frequency (crossover frequency from positive dielectric anisotropy to negative dielectric anisotropy, column 15, lines 10-14), and the electro-optical response is turned off by switching the frequency from high frequency to low frequency (dual frequency electro-optical liquid crystal, column 15, lines 29-33). McKnight teaches that the frequency modulation range of the electro-optical response is for example, in a range of 5 kHz to 100 kHz (column 15, lines 9-10), which is within the claimed range of 20 Hz to 100 kHz. McKnight teaches that the duration of frequency modulation can be from a fraction of a ms to over 1.0 ms (column 14, lines 1-7), which means that a time constant of response concerning turning the electro-optical response on and off is in a range of a fraction of a ms to over 1.0 ms, which overlaps the claimed range of 0.1 ms to 10 ms.

Regarding claim 11, Kobayashi in view of Asano and Suzuki teaches a metal nanoparticle constituting the liquid crystal-soluble particle, as discussed above. In

addition, Kobayashi teaches that the metal nanoparticle is at least one kind of metal atom selected from Fe (column 4, lines 66-68).

Regarding claim 12, Kobayashi in view of Asano and Suzuki, fails to teach a method of driving the liquid crystal device element by using an active matrix mode.

However, McKnight teaches that a method for driving the liquid crystal device element is by using an active matrix mode (column 26, lines 6-13).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to have provided a method of driving the liquid crystal device element of Kobayashi in view of Asano and Suzuki, by using an active matrix mode, in order to utilize the driving properties of the active matrix, as taught by McKnight.

Any inquiry concerning this communication should be directed to Sow-Fun Hon whose telephone number (571)272-1492. The examiner can normally be reached Monday to Friday from 10:00 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Harold Pyon, can be reached on (571)272-1498. The fax phone number for the organization where this application or proceeding is assigned is (571)273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

S. Hon.
Sow-Fun Hon
03/06/06

HAROLD PYON
SUPERVISORY PATENT EXAMINER
1772

3/6/06